

**Consolidated Water Use Efficiency 2002 PSP  
Proposal Part One:  
A. Project Information Form**

1. Applying for (select one): ☒ (a) Prop 13 Urban Water Conservation Capital Outlay Grant  
☐ (b) Prop 13 Agricultural Water Conservation Capital Outlay Feasibility Study Grant  
☐ (c) DWR Water Use Efficiency Project
2. Principal applicant (Organization or affiliation): Contra Costa Water District
3. Project Title: Corrosion Control Leak Mitigation Project
4. Person authorized to sign and submit proposal:
- |                 |                                      |
|-----------------|--------------------------------------|
| Name, title     | <u>Walter J. Bishop, General Mgr</u> |
| Mailing address | <u>1331 Concord Ave</u>              |
| Telephone       | <u>Concord, CA 94520</u>             |
|                 | <u>(925) 688-8034</u>                |
| Fax.            | <u>(925) 688-8197</u>                |
| E-mail          | <u>wbishop@ccwater.com</u>           |
5. Contact person (if different):
- |                  |                                      |
|------------------|--------------------------------------|
| Name, title.     | <u>Scott Nelson, Corrosion Tech.</u> |
| Mailing address. | <u>same as above</u>                 |
| Telephone        | <u>(925) 688-8305</u>                |
| Fax.             | <u>(925) 688-8352</u>                |
| E-mail           | <u>snelson@ccwater.com</u>           |
6. Funds requested (dollar amount): \$3,841,139
7. Applicant funds pledged (dollar amount): \$3,841,139
8. Total project costs (dollar amount): \$7,682,277
9. Estimated total quantifiable project benefits (dollar amount): \$2,859,242 @ 10 years
- Percentage of benefit to be accrued by applicant: 100%
- Percentage of benefit to be accrued by CALFED or others: 0%

**Consolidated Water Use Efficiency 2002 PSP  
Proposal Part One:  
A. Project Information Form (continued)**

10. Estimated annual amount of water to be saved (acre-feet): 117
- Estimated total amount of water to be saved (acre-feet): 1166
- Over \_\_\_\_ years 10
- Estimated benefits to be realized in terms of water quality, instream flow, other:
11. Duration of project (month/year to month/year): 10/02 - 10/05
12. State Assembly District where the project is to be conducted: 11th, 15th
13. State Senate District where the project is to be conducted: 7th
14. Congressional district(s) where the project is to be conducted: 7th, 10th
15. County where the project is to be conducted: Contra Costa County
16. Date most recent Urban Water Management Plan submitted to the Department of Water Resources: December, 2000
17. Type of applicant (select one):
- Prop 13 Urban Grants and Prop 13  
Agricultural Feasibility Study Grants:
- ☐ (a) city  
☐ (b) county  
☐ (c) city and county  
☐ (d) joint power authority  
☒ (e) other political subdivision of the State, including public water district  
☐ (f) incorporated mutual water company
- DWR WUE Projects: the above entities (a) through (f) or:
- ☐ (g) investor-owned utility  
☐ (h) non-profit organization  
☐ (i) tribe  
☐ (j) university  
☐ (k) state agency  
☐ (l) federal agency

18. Project focus:

- ☐ (a) agricultural  
☒ (b) urban

**Consolidated Water Use Efficiency 2002 PSP**

**Proposal Part One:**

**A. Project Information Form (continued)**

19. Project type (select one):  
Prop 13 Urban Grant or Prop 13  
Agricultural Feasibility Study Grant  
capital outlay project related to:

- ☒ (a) implementation of Urban Best  
Management Practices  
☐ (b) implementation of Agricultural Efficient  
Water Management Practices  
☐ (c) implementation of Quantifiable  
Objectives (include QO number(s))

- ☐ (d) other (specify)

DWR WUE Project related to:

- ☒ (e) implementation of Urban Best  
Management Practices  
☐ (f) implementation of Agricultural Efficient  
Water Management Practices  
☐ (g) implementation of Quantifiable  
Objectives (include QO number(s))  
☐ (h) innovative projects (initial  
investigation of new technologies,  
methodologies, approaches, or  
institutional frameworks)  
☐ (i) research or pilot projects  
☐ (j) education or public information  
programs  
☐ (k) other (specify)

20. Do the actions in this proposal involve  
physical changes in land use, or  
potential future changes in land use?

- ☐ (a) yes  
☒ (b) no

If yes, the applicant must complete the CALFED  
PSP Land Use Checklist found at  
[http://calfed.water.ca.gov/environmental\\_docs.ht  
ml](http://calfed.water.ca.gov/environmental_docs.html) and submit it with the proposal.

**Consolidated Water Use Efficiency 2002 PSP  
Proposal Part One  
B. Signature Page**

By signing below, the official declares the following:

The truthfulness of all representations in the proposal;

The individual signing the form is authorized to submit the proposal on behalf of the applicant; and

The individual signing the form read and understood the conflict of interest and confidentiality section and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name and title

\_\_\_\_\_  
Date

# PROPOSAL PART TWO

## Project Summary

Cathodic protection (CP) is a proven, effective, and proactive Best Management Practice (BMP) of mitigating leaks due to corrosion related failures through an electrochemical process. The proof of the effectiveness of CP is most apparent where protection has been applied to old piping systems that had been developing leaks at a rapidly increasing rate. Suitable protection systems can stop the development of further leaks in a dramatic fashion and thus influence water use efficiency.

When CP is planned for existing pipelines that have an established leak history, it is possible to forecast the number and cost of probable leaks that may occur if CP were not applied to the total cost of CP. These costs are evaluated for a period of time, typically 20 to 50 years.

When a section of pipeline system starts to develop leaks, experience has shown that further leaks will develop at a continuously increasing rate. If the accumulated number of leaks repaired is plotted on semilog paper against pipeline age in years, a straight line is the result where accurate leak records are available.

The Contra Costa Water District (CCWD) currently has approximately 116 miles of large diameter water mains in operation. Of this 116 miles, 80% is now under CP. 10% of these pipelines currently are not under CP and exhibiting corrosion loss, which has lead to costly leaks.

Additionally, in order to bring these pipelines under CP, they must be electrically continuous. This is accomplished by providing bonds at each nonconductive joint (e.g., rubber gasketed joints). Of the 10% of pipelines not under CP, 90% are unbonded.

The focus of the proposed project is to provide cathodic protection to 15 miles of distribution piping in the CCWD's treated water system. Also, 50% of these pipelines will need bonding to provide for an electrically continuous pipeline.

The overall goal is to reduce irrecoverable water losses due to leaks caused by pipeline corrosion.

## A. Scope of Work: Relevance and Importance

**1) Nature, Scope, and Objectives of the Project** - The nature of the *Corrosion Control Leak Mitigation Project* is to alleviate corrosion-related leaks on 36 identified pipelines by installing cathodic protection equipment in the Contra Costa Water District's treated water system. The objective is to prevent an estimated loss of 1,116 ac-ft of treated water in the next ten years.

**2) Statement of Critical Local, Regional, Bay-Delta, State or Federal Water Issues** - Contra Costa Water District exports its water directly out of the Bay-Delta. As such, water conserved by the District directly improved the Bay Delta. Corrosion Control will further enhance the existing water conservation program, which has been in place since 1989. It is in the best interests of CCWD and other Bay-Delta water users to promote water conservation through every feasible and economical method. CCWD has had a water conservation program since 1989, including a number of elements. Corrosion Control has proven to provide a significant economic incentive to limit pipeline leakage.

CCWD's Future Water Supply Study (FWSS) analyzed the District's projected water needs through completion of projected build-out in 2040. This study was completed in 1998 and updated in 2001. A major element of the plan to meet future water needs in the FWSS is water conservation programs, where it is estimated that 5% of ultimate water supply would result from conservation programs and projects. The *Corrosion Control Leak Mitigation Project* is consistent with the FWSS conservation estimates and objectives.

## **B. Scope of Work: Technical/Scientific Merit, Feasibility, Monitoring and Assessment**

**1) Methods, Procedures, and Facilities** - Cathodic Protection is a technique to reduce the corrosion rate of a metal surface by making it the cathode of an electrochemical cell. This definition is explained in greater detail here.

There are various conditions that cause pipeline corrosion, and in each case, anodic areas and cathodic areas are present on the pipe surface. At the anodic areas, current flows from the pipeline steel into the surrounding electrolyte (soil or water) and the pipeline corrodes. At the cathodic areas, current flows from the electrolyte into the pipe surface and the rate of corrosion is reduced.

In light of the above, it becomes obvious that the rate of corrosion could be reduced if every bit of exposed metal on the surface of a pipeline could be made to collect current. This is exactly what CP does. Direct current is forced onto all surfaces of the pipeline. The direct current shifts the potential of the pipeline in the active (negative) direction, resulting in a reduction in the corrosion rate of the metal. When the amount of current flowing is adjusted properly, it will overpower the corrosion current discharging from the anodic areas on the pipeline, and there will be a net current flow onto the pipe surface at these points. The entire surface then will be a cathode and the corrosion rate will be reduced. A major activity of a CP engineer is to determine the actual level of CP required to reduce the corrosion rate to an acceptable level. Monitoring, in conjunction with the application of CP criteria, is used for this determination.

If current is forced to flow onto the pipe at areas that were previously discharging current, the driving voltage of the CP system must be greater than the driving voltage of the corrosion cells that are being overcome. The original cathodic areas on the pipe collect current from the anodic areas. Under CP, these same cathodic areas (which were corroding at a negligible rate in the first place) collect more current from the CP system.

For the CP system to work, current must be discharged from an earth connection (ground bed). The sole purpose of this ground bed is to discharge current. In the process of discharging current, the anodes in the ground bed are consumed by corrosion. It is desirable to use materials for the ground bed that are consumed at a much lower rate (pounds/per ampere/per year) than are the usual pipeline metals. This will ensure a reasonably long life for the anodes.

## **PRACTICAL APPLICATION OF CATHODIC PROTECTION**

With the simple theory of CP in mind, a preliminary discussion of the techniques of putting CP into actual use is given below.

### **Cathodic Protection with Galvanic Anodes**

A simple corrosion cell resulting from contact of dissimilar metals takes place when one metal is active (negative) with respect to the other and corrodes. In CP with galvanic anodes, this effect is taken advantage of by purposely establishing a dissimilar metal cell strong enough to counteract corrosion cells normally existing on pipelines. This is accomplished by connecting a very active metal to the pipeline. This metal will corrode, and in so doing will discharge current to the pipeline. In the case of CP with galvanic anodes, CP does not eliminate corrosion; rather, it displaces corrosion from the structure being protected to the galvanic anodes.

Under normal circumstances, the current available from galvanic anodes is limited. For this reason, CP by galvanic anodes is normally used where the current required for protection is small. Similarly, the driving voltage existing between pipe steel and galvanic anode metals is limited. Therefore, the contact resistance between the anodes and the earth must be low for the anodes to discharge a useful amount of current. This means that, for normal installations, galvanic anodes are used in low-resistivity soils. A normal installation, as considered here, is one in which the current from a galvanic anode installation is expected to protect a substantial length of pipeline. There are also instances where galvanic anodes are placed at specific points on a pipeline (often termed hot spots) and may be expected to protect only a few feet of pipe, especially where the line is bare.

### **Cathodic Protection with Impressed Current**

To be free of the limited driving voltage associated with galvanic anodes, current from some outside power source may be impressed on the pipeline by using a ground bed and a power source. The most common power source is the rectifier. This device converts alternating current (AC) electric power to low-voltage direct current (DC) power. Rectifiers usually are provided with the means for varying the DC voltage output, in small increments, over a reasonably wide range. Although the maximum output voltage may be less than 10V or close to 100V, most pipeline rectifiers operate in the range between 10V and 50V and can be obtained with maximum current outputs ranging from less than 10A to several hundred amperes. This serves to illustrate the flexibility in choice of power source capacity available to the corrosion engineer when planning an impressed current CP system.

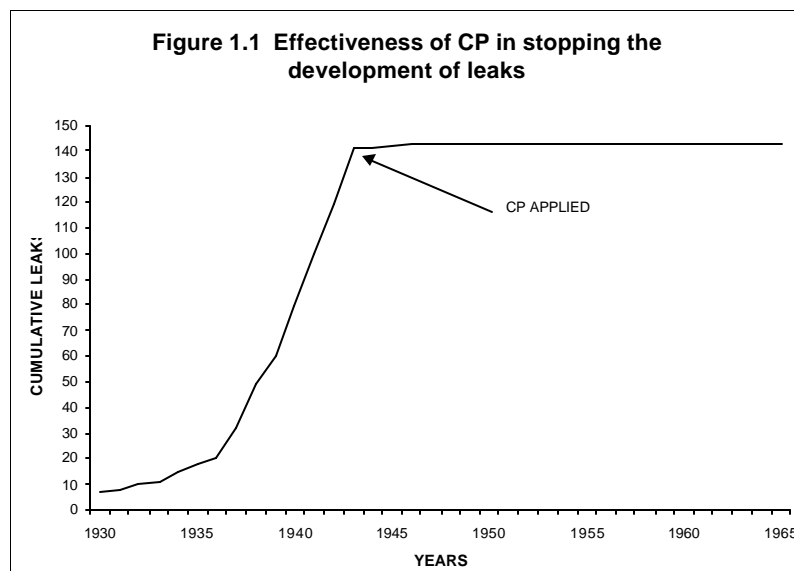
## Criteria for Cathodic Protection

Although the basic theory of CP is simple (impressing DC on a structure to reduce the corrosion rate), the obvious question that arises is: How do we know when we have attained adequate protection on a buried structure? The answer to this question is that various criteria have been developed over the years that permit a determination of whether adequate protection is being achieved. Those criteria in more common usage involve measuring the potential between the pipeline and earth. The measurement permits a rapid and reliable determination of the degree of protection attained. Basically, potential criteria are used to evaluate the changes in structure potential with respect to the environment that are caused by CP current flowing to the structure from the surrounding soil or water.

The potential of a pipeline at a given location is commonly referred to as the pipe-to-soil potential. The pipe-to-soil potential can be measured by measuring the voltage between the pipeline and a reference electrode placed in the soil directly over the pipeline. The most common reference electrode used for this purpose is a copper-copper sulfate reference electrode, which is commonly given the acronym CSE. The potential is referred to as an *on* potential if the measurement is made with the CP system energized. The *off* or *instant off* potential estimates the polarized potential when the measurement is made within one second after simultaneously interrupting the current output from all CP current sources and any other current sources affecting that portion of the pipeline

The proof of the effectiveness of CP is most apparent where protection has been applied to old piping systems that had been developing leaks at a rapidly increasing rate. Suitable protection systems can stop the development of further leaks in dramatic fashion. Woody (Collection of Papers on Underground Pipeline Corrosion, Vol IX) provides an example of such results on a section of pipeline in Houston, Texas, which had been under CP for 20 years. Reduction in the number of leaks was impressive, as shown in Figure 1.1. The curve shows that further leak development was stopped once CP was applied to the pipeline. This study was made on mains in corrosive soil, where leaks were becoming so numerous that abandonment was seriously considered prior to the decision to apply CP. Stetler (1980) reported a similar impressive reduction in the frequency of leaks on a cast iron water main after application of CP.

**Figure 1.1**



## 2) Task List and Schedule

Phase	Task	Task Name	Task Description	Cost	Expected Start	Expected Finish
I	1	<b>Bonding Project Planning</b>		<b>\$12,860</b>	<b>10/01/2002</b>	<b>11/30/2002</b>
		RFP development	Develop RFP for contractor proposals for bond installation			
		Contractor Selection	RFP selection of best contractor for bond installation			
I	2	<b>Bonding Project Administration</b>		<b>\$108,715</b>	<b>12/01/2002</b>	<b>03/31/2004</b>
		Coordinate potential outages	Collaboration with effected groups (e.g., Operations, Water Quality)			
		Contractor management	Oversee Project			
I	3	<b>Bond Installation</b>		<b>\$2,032,283</b>	<b>12/01/2002</b>	<b>03/31/2004</b>
			Bonding for approximately 15 miles of treated water pipelines			
II	4	<b>CP Project Planning</b>		<b>\$14,178</b>	<b>04/01/2004</b>	<b>05/31/2004</b>
		RFP development	Develop RFP for contractor proposals for CP installation			
		Contractor Selection	RFP selection of best contractor for CP installation			
II	5	<b>CP Project Administration</b>		<b>\$109,520</b>	<b>06/01/2004</b>	<b>09/30/2005</b>
		Contractor management	Oversee Project			
II	6	<b>CP Design</b>		<b>\$1,300,455</b>	<b>06/01/2004</b>	<b>11/30/2004</b>
		Soil Resistivity Measurements	Contractor to collect soil data			
		Current Requirement Measurements	Contractor to collect current data			
		Ground bed right-of-way procurement	Acquisition of right-of-way for ground bed installation			
II	7	<b>CP Installation</b>		<b>\$3,956,750</b>	<b>12/01/2004</b>	<b>07/31/2005</b>
			CP Installation for approximately 35 miles of treated water pipelines			
II	8	<b>Data Collection</b>		<b>\$147,516</b>	<b>08/01/2005</b>	<b>09/30/2005</b>
		Data collection & tabulation	data will be used to establish continuing maintenance routine			

### Quarterly Expenditure Projection

	1st Quarter (1/1 - 3/31)	2nd Quarter (4/1 - 6/30)	3rd Quarter (7/1 - 9/30)	4th Quarter (10/1 - 12/31)	Totals
FY 02	\$0	\$0	\$0	\$146,672	<b>\$146,672</b>
FY 03	\$401,436	\$401,436	\$401,436	\$401,436	<b>\$1,605,744</b>
FY 04	\$401,436	\$237,765	\$670,761	\$1,010,232	<b>\$2,320,194</b>
FY 05	\$1,483,779	\$1,483,779	\$642,109	\$0	<b>\$3,609,667</b>
<b>Totals</b>	<b>\$2,286,651</b>	<b>\$2,122,980</b>	<b>\$1,714,306</b>	<b>\$1,558,340</b>	<b>\$7,682,277</b>

3) **Monitoring and Assessment** – The monitoring of the *Corrosion Control Leak Mitigation Project* will be coordinated through CCWD's existing Corrosion Control Program. The same accounting and management procedures used at CCWD will apply to this Project. The activities measured will include:

- ?? Contractor progress
- ?? Budget vs. costs reporting

The outcomes measured will include:

- ?? Rectifier output data such as current and voltage output readings from project equipment (35 rectifiers)
- ?? Pipe-to-soil measurements from project pipelines
- ?? Leak data from project pipelines

Ultimate project success will be realized when no corrosion-related leaks occur on the *Corrosion Control Leak Mitigation Project's* pipelines (15 miles). All data will be stored in a computer database in the Operations & Maintenance Department's Corrosion Control Section.

4) **Preliminary Plans and Specifications and Certification Statement** – See attachment

### C. Qualifications of the Applicants and Cooperators

- 1) **Resume of Project Manager** – See attached
- 2) **Role of External Cooperators** – There will not be any external cooperators other than contactors.

### D. Benefits and Costs

## 1) Budget Breakdown

Budget Item							
	Bonding Project Planning	Bond Installation	CP Project Planning	CP Design	CP Installation	Data Collection	Total
Land Purchase, Easement				\$200,688			<b>\$200,688</b>
Planning, Design, Engineering	\$12,860		\$14,178	\$240,825			<b>\$267,863</b>
Materials, Installation		\$15,200			\$57,000		<b>\$72,200</b>
Structures							<b>\$0</b>
Equipment Purchases, Rentals							<b>\$0</b>
Environmental Mitigation, Enhancement							<b>\$0</b>
Construction, Administration, Overhead		\$1,854,580		\$281,895	\$3,954,510	\$134,102	<b>\$6,225,087</b>
Project, Legal, License Fees		\$7,049		\$16,055			<b>\$23,104</b>
Contingency		\$264,169		\$602,062			<b>\$866,231</b>
Other						\$27,104	<b>\$27,104</b>
Total	<b>\$12,860</b>	<b>\$2,140,998</b>	<b>\$14,178</b>	<b>\$1,341,525</b>	<b>\$4,011,510</b>	<b>\$161,206</b>	<b>\$7,682,277</b>

## Bonding Assumptions

Pipe Dia. (In.)	<sup>(1)</sup> Bonding (mile)	Number of Bonds	Materials & Crew Cost/Day	Bonds/Day	Total
12-16	4.0	4x5280/30 = 704	2332	/ 7	234,533
18-20	5.0	5x5280/30 = 880	2550	/ 6	374,000
24-36	5.0	5x5280/30 = 880	2700	/ 5	475,200

1,083,733

(1) 75% of total (5.4, 6.6 and 6.7 in the respective diameters)

Crew			Other Costs		
1 VT Op			Patches	189 / day	
1 T Op/Laborer			ETS	42 / day	
1 Bonder/Laborer			Bonds	140 / day	
1 Laborer			w/add-ons		
4 x 8 x 50 =	1600 / day		Totals =	2332	12" - 16"
Equip. =	400 / day			2550	18" - 20"
	2,000 / day @ cost			2700	24" - 36"

### **CP Assumption**

<b>Assume:</b>	1 / 1/2 mile for 18.7 miles
	Use 38 rectifiers @ 65,000 each = \$ 2,470,000

### **Contingency Justification**

The 15% contingency is based upon the following:

- ?? Variations in the number of interested bidders
- ?? Clarity of bidding documents
- ?? Increase in cost due to construction materials and supply fluctuations
- ?? Other unforeseen costs

### **2) Cost-Sharing**

CCWD proposes 50-50 cost-sharing as follows:

	CALFED Share	CCWD Share	<b>Total</b>
Bond Installation Project	\$1,076,929	\$1,076,929	<b>\$2,153,858</b>
CP Installation Project	\$2,764,210	\$2,764,210	<b>\$5,528,419</b>
<b>Total</b>	<b>\$3,841,139</b>	<b>\$3,841,139</b>	<b>\$7,682,277</b>

### **3) Benefit Summary and Breakdown – See next section (D.4)**

**4) Assessment of Costs and Benefits** - When a section of pipeline system starts to develop leaks, experience has shown that further leaks will develop at a continuously increasing rate. If the accumulated number of leaks repaired is plotted on semilog paper against pipeline age in years, a straight line is the usual result where accurate leak records are available. In this instance, the first leak did not

The application of CP as shown in Figure 1.2 can mitigate development of new leaks. The cost of operating a CP system(s) versus the cost of leaks over a period of time can then be economically evaluated. In the case illustrated (Figure 1.2), application of CP at the end of the 12<sup>th</sup> year would eliminate approximately 70 new leaks over the next 10-year period. Thus, a dollar figure can be developed to represent the cost savings for the anticipated leaks.

To determine the cost of leaks, several items should be considered:

?? The value of water lost from an average corrosion leak. This will depend on the pipeline pressure, the average size of the leak, and the average length of time that product escapes before the leak repair is accomplished.

Assume: avoided cost is \$350/AF

Assume: average corrosion leak is .27 AF/month

Assume: average length of leak before its detected is 24 months

Other items that need to be considered are:

?? The average cost of a leak repair on the pipeline under study. This should include labor, overhead, materials, transportation costs, and other attendant expenses.

?? An average cost for property damages associated with a simple corrosion leak repair.

?? Miscellaneous factors, such as insurance, good will, and other costs.

The total average cost of each leak will be the sum of the above items plus any associated costs that may be involved for the particular pipeline system under consideration.

Now assume that a coated pipeline having the leak represented by Figure 1.2 is surveyed during its 12<sup>th</sup> year and that design calculations indicate that CP can be applied using a rectifier system. Further, assume that the annual operating costs will be \$2,134 per year and it has been established that the average total cost of each leak repaired is \$4,488 (including \$2268 of lost water). Using these figures, if CP is applied at the end of the 12<sup>th</sup> year, comparative costs for the following 10-year period are as follows:

? ? CP costs:  $10 \times \$2,134 = \$21,340$

? ? Savings in leak costs:  $70 \times \$4,488 = \$314,160$

This example indicates that over the 10-year period there will be net savings of \$292,820 with CP installed if all leaks are avoided. CCWD proposes to protect 36 pipelines, thus:

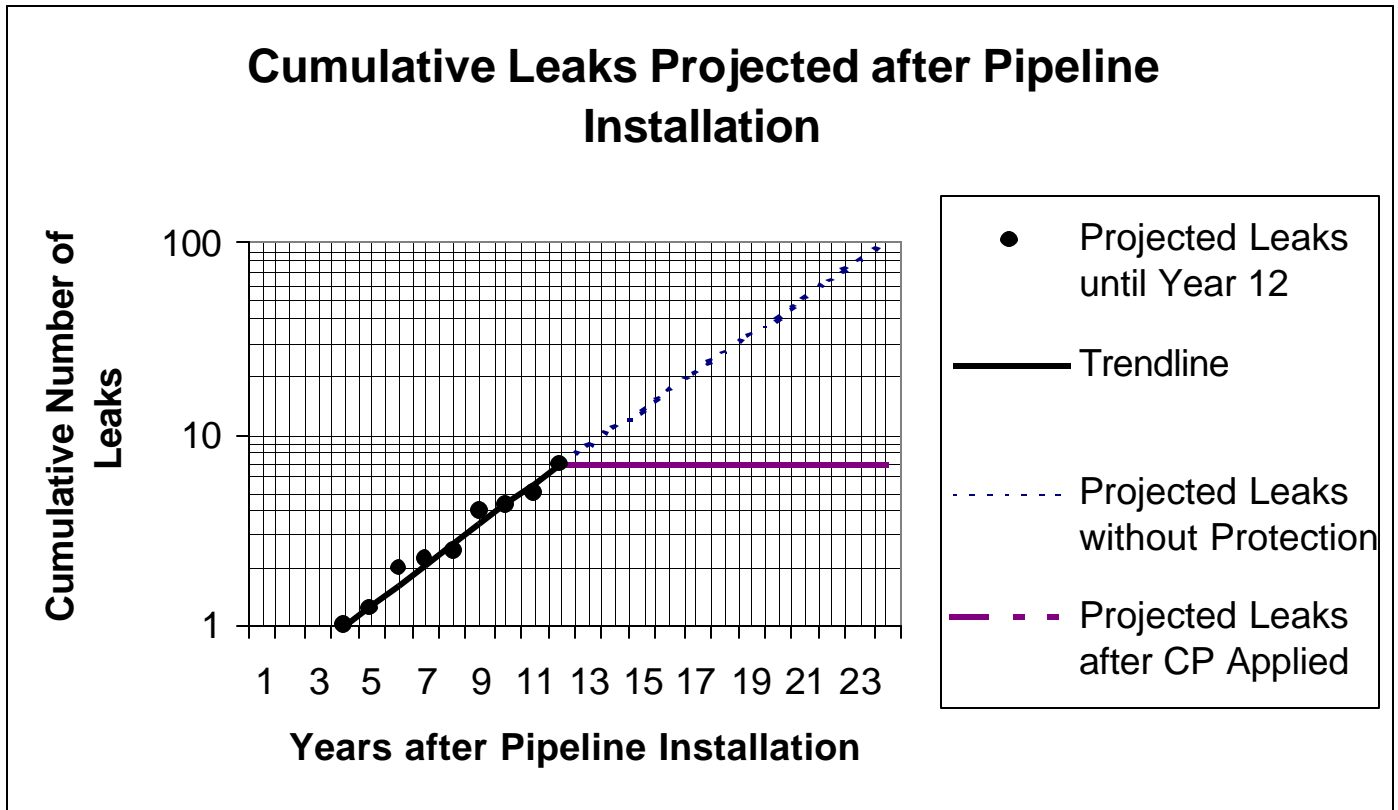
? ? Total CP costs:  $36 \times \$21,340 = \$768,240$

? ? Total savings in leak costs:  $36 \times \$314,160 = \$11,309,760$

This 10-year projection for 36 pipelines with CP installed indicates a \$10,541,520 savings if all leaks are avoided.

Greater savings can be shown by projecting the comparison over a longer period because, although annual CP costs remain reasonably uniform, the number of projected leaks over that longer period increases very rapidly. (Note from Figure 1.2, that there would be approximately 20 new leaks in the 23<sup>rd</sup> year alone.)

Figure 1.2



This proposed Prop 13 Urban Grant is locally cost effective, whereas the benefits to CCWD are greater than the costs.

Beneficiary	Costs		Benefits		
	Installation Costs	Annual Costs (10-Years)	Project 10-Year Savings (Water in AF)	Project 10-Year Savings from Potential Leaks (\$)	
CCWD	\$3,841,139	\$768,240	1166 AF	\$11,309,760	\$2,859,242
CALFED	\$3,841,139	\$0	1166 AF	\$0	

#### E. Outreach, Community Involvement and Acceptance

The public may be affected by this project due to planned construction and water disruptions when the project pipelines are bonded and CP applied. However, necessary means for alternative

water will be available to the public (e.g., bottled water). These potential inconveniences are negligible compared to an unplanned pipeline corrosion failure.

The Bay Area Rapid Transit District (BARTD) is aware of CCWD's efforts to mitigate the effects of stray current by installing CP on pipelines. Over the years, stray current from the BART's direct current rail system has had an accelerating effect on corrosion damage seen on CCWD's pipelines. Since November, 1970, CCWD and BARTD has work together intermittently to try to solve this problem, however, the conclusion was that the only way to adequately remedy the problem of stray current is to install CP systems. Upon approval of the *Corrosion Control Leak Mitigation Project*, correspondence with BARTD will proceed to apprise them of CCWD's goal.

**Preliminary Plans and Specifications and Certification Statements  
For the *Corrosion Control Leak Mitigation Project***

Preliminary Plans:

Types and Quantities of Materials

Pipe Dia. (In.)	<sup>(1)</sup> Bonding (mile)	Number of Bonds	Bonds/Day
12-16	4.0	4x5280/30 = 704	7
18-20	5.0	5x5280/30 = 880	6
24-36	5.0	5x5280/30 = 880	5

Use 38 rectifiers

Specifications:

See attached.

Certification Statements:

I hereby verify that the *Corrosion Control Leak Mitigation Project* is feasible using the identified materials listed.

---

Michael D. Holley  
Contra Costa Water District, P.E.

## **CORROSION CONTROL FOR BURIED STRUCTURES**

### **1.0 GENERAL**

#### **1.1 The Requirements**

- A. The CONTRACTOR shall furnish all materials, install all equipment and provide all labor necessary to complete the work shown on the drawings and or/listed below and all other work and miscellaneous items not specifically mentioned but reasonably inferred, including all accessories and appurtenances required for a complete system. The intent of this specification is to provide for complete, functional cathodic protection systems for 15 miles of identified pipeline including associated casings and appurtenances.
- B. Work included in this section consists of all components of the cathodic protection system; including anodes, rectifiers, cables, test stations, and any other work necessary to complete the installation. Work on this project includes the following items:
  - 1. Cathodic protection of 15 miles of mortar- coated, welded steel pipeline.
  - 2. Cathodic protection of welded steel laterals.
  - 3. Cathodic protection of steel casings.
  - 4. Cathodic protection of pipeline appurtenances such as blow-offs and ARV's.
  - 5. Bonding of flanges, flexible couplings and other non-welded fittings.
  - 6. Trenching AC conduits through city streets and crossing bridges.
  - 7. Installation of magnesium anodes, cables, insulating joints and test stations.
  - 8. Drilling, installation of deep anode wells, installation of rectifier units, running AC power for the rectifier unit, associated conduits and electrical meter sockets.
  - 9. Backfill and compaction of backfill.
  - 10. Provide shop drawings, reports, permits, and obtain Construction Administrator's approval where required.
  - 11. Correction of all deficiencies.
  - 12. Coordinating electrical work with PG&E, including installation of power pole w/ step-down transformer, hookups to PG&E secondary power boxes and transformers.

13. The work shall include the provision of all materials, equipment, and apparatus not specifically mentioned herein or noted on the plans, but which are obviously necessary to complete the work specified.

## 1.2 **Contractor Submittals**

- A. Submittals shall be furnished in accordance with CCWD requirements.
- B. A complete list of equipment and material, including name and manufacturer, catalog number, size, finish and any other pertinent data necessary for proper identification and to determine conformance with specifications.
- C. A certified test report for all anode backfill material including chemical analysis, resistivity, and gradation.
- D. A certified test report showing the chemical analysis of all anodes.
- E. Certification by the cable manufacturer, covering conformance of cable insulation to designated specification.
- F. Wiring diagram for the rectifier unit showing all components.

## 2.0 **PRODUCTS**

### 2.1 **General**

- A. All materials shall conform to the requirements set forth herein or as designated on the drawings, unless otherwise specified. All materials must be new, free from defects, and shall be of the best commercial quality for the purpose specified. The CONTRACTOR shall furnish all necessary items and accessories not shown on the drawings or specified herein, but which are required to fully carry out the specified intent of the work, without additional cost to the DISTRICT.

### 2.2 **Permits and Reports**

- A. Prior to commencing construction of deep well anodes, the CONTRACTOR shall apply to the Contra Costa County Environmental Health Department for well permits for the deep well anode beds and shall comply with Contra Costa County ordinances. In addition, the CONTRACTOR shall comply with all necessary requirements of Sections 13750 and 13755, Division 7, Chapter 10, Article 3 of the California Water Code. Copies of a detailed log of the well along with all reports shall be forwarded to the Construction Administrator and to State or County agencies requiring such logs. During installation, the CONTRACTOR shall comply with all requirements of the Contra Costa County Health Officer.

### 2.3 **Electrical Service**

- A. Electrical service for the cathodic protection rectifiers shall be obtained from the locations designated on the drawings. The CONTRACTOR shall furnish and install all required wiring, conduits, cables, splice boxes, power poles, step-down transformers, meter sockets and equipment as necessary for

operation of the rectifiers and as required by PG&E. The CONTRACTOR shall pay all fees involved in obtaining the electrical service.

## 2.4

### **Rectifiers**

A. Thirty-eight (38) rectifiers are required for this project. The rectifiers shall be the product of a concern currently engaged in the manufacture of cathodic protection equipment and shall conform in all respects to NEMA Standards. The rectifiers shall be silicon full-wave bridge, dual voltage 120/220V AC, 60-cycle, single-phase, 12 volts-6 amperes DC, air-cooled as indicated on the drawings, designed for continuous operation at 45° C ambient temperature and shall include the following features:

1. Output rating: 12V-6A DC
2. Transformer taps that will permit manual adjustment of output voltage between zero and maximum voltage in 20 evenly divided steps.
3. Thermal magnetic circuit breaker, plastic encased, for overload protection or primary and secondary.
4. Transient protection for AC and DC circuit.
5. Lightning protection for primary circuit.
6. Separate meters for current and voltage output with 2-percent accuracy.
7. Silver plated connectors and adjustment bars.
8. Pressure type connectors for DC output cables marked "Pipe," "Anode," and "Test."
9. Equipped for pad mounting.
10. Individual shunt terminals as indicated on the drawings for the anodes and the pipe.
11. Efficiency Filter: The DC output filter shall be fitted with a bypass circuit and switch of sufficient capacity for 150-percent of full load. The switch shall be marked "Efficiency Filter" with "off" and "on" positions clearly labeled. With the "Efficiency Filter" switch in the "on" position, the bypass circuit will be open, and the DC output filter will be in operation.
12. Air-Cooled Rectifier Enclosure: Housing shall be weatherproof, oil-cooled type, NEMA 3R enclosure constructed of 11 gage galvanized steel, with two coats of white paint, free of warps and wrinkles, and shall be equipped with padlock hasp. The enclosure shall be adequately sized to include all components as indicated herein.
13. Input power to rectifiers shall be dual voltage, 120/220V, 60-cycle, single phase.

## 2.5

**Impressed Current Anodes**

- A. Impressed current anodes shall be 2.66-inch nominal diameter by 84-inches long, high silicon cast iron, tubular anodes. Each anode shall have a minimum weight of 63-pounds, a minimum surface area of 4.9-square feet, and shall be furnished with a cable attached to the interior cylinder. Composition of the anodes shall conform to the following requirements:

ELEMENT	MIN. %	MAX. %
Silicon	14.2	14.75
Carbon	0.8	1.1
Manganese	--	1.5
Chromium	3.0	6.0
Iron	Bal.	Bal.

The cable attached to the anodes shall be No.8 AWG, stranded, single conductor, copper, Type-CP, of sufficient length to connect to the anode terminal inside the rectifier housing. The cable shall be insulated for 600-volts with high molecular weight polyethylene in accordance with the requirements of ASTM-D-1248, Type-1, Class-C, Grade-5, and ICEA-NEMA S-61-402. Connection of the cable to the anode shall be accomplished as shown on the drawings, and pulling strength of the connection shall exceed the tensile strength of the cable. Any damage to the cable insulation or anode will require complete replacement of the cable and anode.

## 2.6

**Anode Backfill**

- A. Backfill material for impressed current anodes shall be calcined coke breeze with a minimum carbon content of 98-percent by weight and a resistivity of 25-ohm-cm or less when tested with an applied pressure of two pounds per square inch. The backfill material shall conform to the following gradation requirements:

SIEVE SIZE	PERCENT PASSING
3/8	100 min.
1/8	5 max.

## 2.7

**Magnesium Anodes**

- A. Magnesium anodes shall be of the size indicated on the drawings. Each anode shall be cast with a steel core, and the core shall protrude from one end and shall be of sufficient length to permit attachment of a lead wire.

- B. Each anode shall conform to the following chemical composition:

Silicon	0.30% Max.
Aluminum	5.0 - 7.0% Max.
Manganese	0.15% Min.
Iron	0.03% Max.
Nickel	0.003% Max.
Copper	0.1% Max.
Zinc	2.0 - 4.0% Max.
Total Other Impurities	0.30% Max.
Magnesium	Balance

- C. Each anode shall be furnished with a lead wire attached to one end of the steel core, and the wire shall be of sufficient length to attach to the test station as designated on the drawings. The wire shall be connected to the steel core by silver soldering, and the connection shall be mechanically secure before soldering with at least three turns of wire at the connection. The entire connection shall be insulated with an electrical potting compound. The cable attached to the anode shall be No.10 AWG, Type RHW-USE solid, single conductor, and shall conform to Federal Specification JC-30B.
- D. The anode shall be prepackaged in a permeable cloth bag filled with a backfill mixture of 75 percent ground hydrated gypsum, 20 percent powdered bentonite, and 5 percent anhydrous sodium sulfate. Backfill mixture shall have a grain size so that 100 percent is capable of passing through a 100-mesh screen. The mixture shall be firmly packed around the anode within the cloth bag by means of adequate vibration so that the magnesium ingot is completely surrounded with a minimum one-inch of backfill material.

## 2.8

### **Cables**

- A. All underground cables utilized for drain and bonding cables shall be single conductor, stranded copper, Type CP, insulated for 600 volts with High Molecular Weight Polyethylene (HMWPE) in accordance with the requirements of ASTM D 1248, Type 1, Class C, Grade 5 and ICEA NEMA S 61 402.
- B. All cables for galvanic anodes and test stations shall be Type THHN/THWN, solid, copper, sized as shown on the plans, and shall conform to Federal Specifications JC-30B
- C. All impressed current anode cables shall be single conductor, stranded copper, Type CP, insulated for 600 volts with Halar (E-CTFE Fluoro-Copolymer Thickness of 0.020-inches) and a High Molecular Weight Polyethylene (HMWPE) jacket, in accordance with the requirements of ASTM D 1248, Type 1, Class C, Grade 5 and ICEA NEMA S 61 402.

## 2.9

### **Cable-to-Pipe Connections**

- A. The cable connections to the steel pipelines shall be accomplished utilizing an exothermic welding process as shown on the drawings. Each cable shall be fitted with a copper sleeve for accomplishing the weld and cartridge, sleeves and molds for each weld shall be furnished by the same manufacturer. All materials for welding shall be sized and in accordance with recommendations in manufacturers' literature. Where shown on the

drawings, the cable connections shall be made by welding a prefabricated rod & cable assembly to the pipeline.

B. Manufacturers, or equal

1. **"Cadweld" by Erico Products, Inc.,**
2. **"Thermoweld" by Continental Industries, Inc.**

2.10 **Cable-To-Pipe Coating**

A. Epoxy shall be used for sealing the cable to pipe connections.

B. Manufacturers, or equal

1. **Durcon-164, by Duriron Company**
2. **Scotchcast Resin No. 4, by 3-M Company**
3. **CC-1 Potting Compound, by PSI Products.**

2.11 **Metering Shunts**

A. Anode metering shunts shall be 0.01 ohm, 6 amp capacity, with 1% accuracy.

B. Metering shunts at bonds shall be 0.001 ohm, 25 amp capacity, with 1% accuracy

C. Manufacturers, or equal

1. **Cott Manufacturing Company.**

2.12 **Flush Grade Test Station**

A. Flush grade test stations shall be traffic boxes with cast iron cover as shown on the drawings. Terminal boxes shall be locking type, constructed of high-impact, molded Lexan plastic. The test box shall be provided with sufficient hardware and terminals for each cable as shown on the drawings. All test station hardware, including nuts, bolts and shorting straps shall be nickel plated brass.

B. Manufacturers, or equal

1. Valve Boxes will be provided by the District
2. Terminal Boxes shall be Model "Big Fink" by Cott Manufacturing Company

2.13 **Cable Warning Tape**

A. All buried anode and test station cables shall have plastic warning tape installed a minimum of 12 inches above the top of the cables for the entire buried length of the cables. The warning tape shall be 4 in. wide and shall be yellow with black lettering with the legend "CAUTION, CATHODIC

PROTECTION CABLES BURIED BELOW" in 3 in. high lettering printed at a minimum of seven foot intervals along the entire buried length of the cable.

2.14 **Cable Identification Tag**

- A. All cables in the terminal boxes shall be identified. The identification tags shall be white plastic "zip-tie" type straps with a plastic tab of sufficient size to allow the pipeline station to be written on the tab with a permanent felt tip marker.

2.15 **Insulating Flanged Joints**

- A. Each insulating flange set shall consist of a full-face central gasket, a full-length sleeve for each flange bolt, and two insulating washers with two steel washers for each bolt. The ring-type central gasket shall be 1/8-inch thick sheet packing, having a dielectric constant of 300 volts per mil, minimum. Bolt sleeves shall be fabric reinforced phenolic resin or mylar, and insulating washers shall be constructed of fabric reinforced phenolic resin. The complete assembly shall have an ANSI pressure rating equal to that of the flanges between which it is installed.

2.16 **Rigid Steel Conduit and Fittings**

- A. Rigid steel conduit and fittings shall be hot-dipped galvanized and shall conform to ANSI Specification C80.1 for Rigid Metallic Conduit.

2.17 **Rigid PVC Conduit and Fittings**

- A. Rigid polyvinylchloride (PVC) conduit and fittings shall be Schedule 80, manufactured to NEMA TC-2 and WC-1094 specifications and shall be U.L. approved.

2.18 **Vent Pipe**

- A. Rigid Schedule 80 PVC pipe, 2-inch diameter

2.19 **Grounding Conductor**

- A. The grounding conductor shall be No.8 AWG, copper, minimum.

2.20 **Ground Rods**

- A. Ground rods shall be 5/8-inch by 8-feet long copper or copper clad steel.

2.21 **Cement Grout**

- A. Grout used for sealing the anode well shall be non-shrink type composed of two parts by weight of sand to one part of cement and five to seven gallons of water per sack of cement. Type-II modified, Portland cement conforming to the provisions of Section 90-2.01 of the State of California Specifications shall be used in the grout. Grout shall conform to Department of Water Resources Bulletin 74-90.

2.22 **Centering Devices**

- A. Centering devices for centering anodes in the well shall be designed and fabricated by the CONTRACTOR and shall be submitted to the Construction Administrator for approval prior to use. The device shall be constructed of carbon steel and shall be designed to permit easy adjustment in the field.

2.23 **Bitumastic**

- A. Bitumastic for coating couplings and insulating flanged joints shall conform to the requirements of Bureau of Reclamation Specifications CA-50.

2.24 **Buried Insulating Joint and Harness Set Coating Material**

- A. Buried Insulating Joint and Harness Set Coating Material: Coatings for buried insulating flanges and insulating couplings, etc, shall consist of a non-conductive, petrolatum-based coating system. The coating system shall consist of a prime coat as an initial surface preparation to displace moisture on the surface and to improve adhesion of the wax tape. A wrap material shall be used to provide a smooth contour on the surface of the joint as well as for protection of the substrate. An over wrap shall be used as a final coating to provide increased mechanical strength of the coating. The prime coat shall be a petrolatum material with corrosion inhibitors and plasticizers. The wrap coat shall be a synthetic fabric saturated with a blend of petroleum wax, plasticizers and corrosion inhibitors. The over wrap shall be plasticized, self adhesive PVC tape.
- B. Manufacturers, or equal
  - 1. Trenton Wax Tape #1 by The Trenton Corporation

2.25 **Insulating Union**

- A. Insulating unions shall be constructed of malleable iron in three parts as shown the drawings and the body of the union shall be threaded. The union shall be rated for 150 pounds per square inch water pressure at 200 degrees F and shall have a one-piece nylon insulating fitting. The nylon insulating fitting shall have a dielectric constant of 200 volts per mil, minimum.

2.26 **Insulating Blanket**

- A. Insulating blanket shall be 1/8-inch thick sheet of butyl rubber, PVC, HDPE, Micarta or Neoprene.

2.27 **Mortar Coating of Valve Assemblies, ARV & BO Piping**

- A. Where indicated on the plans, the mortar coating shall be in accordance with CCWD standards.

### 3.0 **EXECUTION**

#### 3.1 **Material Delivery, Storage and Protection**

- A. All materials and equipment to be used in construction shall be stored in such a manner to be protected from detrimental effects from the elements. If warehouse storage cannot be provided, materials and equipment shall be stacked well above ground level and protected from the elements with plastic sheeting or other method as appropriate.

#### 3.2 **General**

- A. All materials, workmanship and installation shall conform with all requirements of the legally constituted authority having jurisdiction. These authorities include, but are not limited to, the latest revision of the State of California, Department of Industrial Relations, Division of Industrial Safety, Electrical Orders; The National Electric Code, General Construction Safety Orders of the Industrial Accident Commission; and all other applicable State, County, or City codes and regulations. Nothing in the drawings or specifications is to be construed to permit work not conforming to these regulations and codes. Where larger size or better grade materials than required by these regulations and codes are specified, the specifications and drawings shall have precedence.

#### 3.3 **Electrical Service**

- A. Electrical service for the cathodic stations shall be provided by the CONTRACTOR and shall be provided in strict accordance with NFPA 30, NEC and the local codes.
- B. Contractor shall coordinate obtaining electrical service for the thirty-eight (38) rectifiers with PG&E. The Contractor shall be responsible for furnishing and installing the necessary wiring, conduit, cables, splice boxes, AC meter pedestals power poles, step-down transformers and equipment to the service connection as required by PG&E. The Contractor shall be responsible for paying any charges or fees to PG&E for electrical service. PG&E representatives shall be contacted a minimum of 12 weeks prior to the start of construction.
- C. AC meter pedestals are required at all rectifier locations shall be 110-volt, single phase.

#### **Rectifiers**

- A. The rectifiers shall be mounted and connected to the power supplies as shown on the drawings. The cables connected to the pipeline shall be connected to the negative output terminal of the rectifiers, and the cables connected to the anodes shall be connected to the positive terminals of the rectifiers.

#### 3.5 **Deep Well Anodes**

- A. The deep well anode bed shall be installed in accordance with Department of Water Resources Bulletin 74-90 in all respects.

- B. The CONTRACTOR shall inform the Construction Administrator 72-hours prior to starting drilling for installation of the anode well. He shall report progress daily and shall inform the Construction Administrator at least 24-hours in advance of placing anodes and backfill in the well. The Construction Administrator will inspect the well, check the viscosity of drilling mud in the well for suitability of placing backfill material and will carefully check anodes, vent pipe, cable, and backfill material before placement.
- C. A 10-inch diameter hole shall be bored to the depth shown on the drawings. Drilling mud shall be cleaned from the hole by pumping clean water into the bottom and the hole approved by the Construction Administrator prior to installation of anodes or coke breeze backfill. If necessary, the CONTRACTOR shall install necessary casing or other approved materials to prevent caving of the hole during installation of anodes and coke breeze backfill. All metallic casing installed above anode backfill material shall be removed prior to introducing the sand plug and grout seal. Non-metallic casing installed around anodes shall be removed, and non-metallic casing installed above anode backfill material may be left in place. No additional compensation will be allowed for casing or other devices used to prevent caving.
- D. The terminal end of the cables shall be identified via crimping, then anodes shall be attached to the vent pipe with steel bands and lowered into the hole. Anodes shall be centered in the hole with approved centering devices. At no time shall any anode cable be allowed to support the weight of any anode. Anode cables shall be protected at all times to prevent damage to the insulation. Cables shall be bundled and taped at 10-foot intervals to the vent pipe. When necessary to prevent failure of the vent pipe during installation of anodes, a nylon or other approved non-metallic rope shall be attached to the vent pipe and anode supports at appropriate intervals to provide additional support. The rope may be left in place.
- E. A soil resistivity instrument, furnished and operated by the Construction Administrator, shall be connected between the anode cable for the bottom anode and the drain cable to determine the resistance between bottom anode and the pipe. The drain cable must be accessible to the Construction Administrator during time of testing. Pre-soaked coke breeze shall then be introduced into the hole in such a manner to prevent bridging or the creation of voids. At the time of introduction of backfill, the hole shall contain sufficient water to minimize the possibility of bridging. In the event that voids or bridging does occur, the CONTRACTOR shall correct the deficiency to the satisfaction of the Construction Administrator.
- F. As the coke breeze surrounds the bottom anode, the resistance between the anode and pipe will gradually decrease as indicated on the resistivity instrument. When the resistance of the bottom anode has decreased to a constant value, the anode shall be considered to be completely surrounded with coke breeze. The resistivity instrument shall then be connected to the cable for the second anode from the bottom of the hole and additional backfill added until resistance measurements indicate the second anode has been covered. This process shall continue on succeeding anodes until the upper surface of the coke breeze is at least ten feet above the top of the anode which is nearest the ground surface. In the event that bridging does occur at any time during introduction of the backfill, the operation shall cease until the void has been eliminated. After the coke breeze has been placed and approved, all metallic components projecting more than five feet above the

top of the last anode shall be removed. A 5-foot plug of sand shall be placed in the well immediately above the top of backfill material. The remainder of the hole shall be filled with cement grout to the elevation shown on the drawings. Grout shall be placed by the tremie method, and the pipe used to place the grout shall be properly shielded to prevent damage to cable insulation.

### 3.6 **Cables**

- A. Cables buried in the ground shall be direct buried and shall be laid straight, without kinks. The cable shall have a minimum cover of 30 in. Each cable run shall be continuous in length and free of joints or splices. Care shall be exercised during installation to avoid punctures, cuts, and similar damage to insulation. Any damage to insulation will require replacement of the entire cable length. Backfill surrounding the cables shall be native soil free of foreign materials. Cable warning tape shall be installed 12-inches above the entire buried length of the cable.

### 3.7 **Cable-To-Pipe Connections**

- A. Cable-to-pipe connections shall be installed in the manner and at the locations shown on the drawings. Coating materials shall be removed from the pipe surface over an area just sufficient to make the connections. The surface shall be cleaned to white metal by grinding or filing prior to welding the conductor. Grinding with resin impregnated wheels shall not be allowed. The conductor shall be welded to the pipe by the exothermic process with a copper sleeve fitted over the conductor, and only sufficient insulation shall be removed from the conductor to allow placing in welding mold. After the weld has cooled, all slag shall be removed and the weld shall be tested with a sharp blow from a 22 ounce hammer to assure proper metallurgical bond. All defective welds shall be removed and replaced. All exposed surfaces of copper and steel shall be covered with a minimum thickness of 1/4 in. of insulating materials as shown on the drawings. Where shown on the drawings, the connection shall be made by welding a prefabricated rod and cable assembly to the pipeline at the pipe joints.

### 3.8 **Test Stations**

- A. Exact locations of test stations shall be determined by the ENGINEER in the field. The terminal end of each cable shall be identified with the structure identification using the permanent cable identification tags.
- B. The test station leads shall be tested by the CONTRACTOR and results approved by the ENGINEER prior to backfill.

### 3.9 **Joint Bonding**

- A. All non-welded rubber gasket joints, mechanical joints, flange joints and threaded joints shall be bonded with a insulated copper cable, sized appropriately. The overall length of the conductor shall permit maximum movement of the pipe joint without transferring any tensile stress to the cable, per pipe manufacturers recommendations.
- B. It is the intent of this bonding specification is to ensure that electrical continuity is provided to the entire length of the project pipelines. Bonding is to be used on all non-insulated joints along these pipelines that are not

welded. Bonding shall not be performed where insulating flanges have been specified.

3.10 **Insulating Flanged Joints**

- A. All insulating components of the insulating flanged gasket set shall be cleaned of all dirt, grease, oil and other foreign materials immediately prior to assembly. Bolt holes in mating flanges shall be properly aligned at the time bolts and insulating sleeves are inserted to prevent damage to the insulation. After flanged bolts have been tightened, each insulating washer shall be inspected for cracks or other damage. All damaged washers shall be replaced. After assembly, resistance between each bolt and flange shall be measured with an approved ohmmeter, and the minimum resistance shall be 50,000 ohms. Where the insulating joint is assembled in the shop and shipped as a unit, resistance shall be measured in the shop between the flanges and between each bolt and flange and shall meet the above requirements. All insulating flanged joints shall be coated as shown on the drawings and specified below.
- B. The testing shall be conducted in the presence of the DISTRICT's representative and approved by him prior to backfill.

3.11 **Coating Insulating Flanged Joints and Harness Sets**

- A. Surfaces shall be cleaned of all dirt, grease, oil and other foreign materials immediately prior to coating. Remove loose rust, paint and other foreign matter in accordance with SSPC SP2 or SP3. A prime coating shall be applied in a uniform coating over the entire surface to be wrapped. A liberal coating shall be applied to threads, cavities, shoulders, pits and other irregularities. A fill coating shall be molded and packed onto irregular surfaces such as flanges, valves or flexible couplings to create a smooth profile prior to wrapping. A wrap coating shall be spirally wrapped using a minimum of 55 percent overlap to ensure a double thickness of material. At the completion of each roll the overlaps shall be smoothed by hand in the direction of the spiral to ensure sealing of the overlap. A 2-inch overlap shall be maintained when overlapping one roll with the end of a new roll. Overlap shall occur on the top half of the pipeline. A guard coating shall be spirally over-wrapped using a 55 percent overlap to ensure a double coating.

3.12 **Foreign Pipeline Test Stations**

- A. All material and labor associated with installation of test and bond cables on foreign owned/operated pipelines shall be provided by others. The CONTRACTOR'S responsibility associated with the installation of test/bond cables on foreign pipelines will be to excavate and provide access to a sufficient portion of the foreign pipeline in order to allow the foreign pipeline company personnel to make cable connections to the pipeline. The CONTRACTOR shall be responsible for termination of foreign pipeline test/bond cables in the Contra Costa Water District test box, as directed by the foreign pipeline company representative. Excavation work by the CONTRACTOR shall be substantially limited to the confines of the Contra Costa Water District pipeline trench. The CONTRACTOR shall be responsible for notification of all foreign pipeline operators 72 hours prior to excavation of the foreign pipeline.

- B. A dielectric blanket shall be installed at all crossings in between the project pipeline and the foreign pipeline, as shown in the drawings. The width and length of the blanket shall be two feet more than the diameter of the largest pipeline at the crossing.

### 3.13 **Mortar Coating of Valve Assemblies, ARV & BO Piping**

- A. Where indicated on the plans, a mortar coating shall be applied in accordance with CCWD standards. All in-line valves along the project pipelines shall be mortar coated. All piping and valves associated with ARV's, Blow-Off's and other appurtenances which are located on the project pipelines side of the specified insulating flanges, shall be mortar coated in accordance with this specification.

## 4.0 **SYSTEM COMMISSIONING**

- A. After installation of the cathodic protection facilities, the system shall be tested, and adjusted by [a State of California Registered Professional Engineer, to assure conformance with the specifications. Testing shall include a determination of proper installation of each component, adequacy of test stations and insulating joints, anodes, dielectric insulation and electrical continuity of bonded pipe fittings. Upon completion of tests, a detailed report will be submitted describing any deficiencies detected. Any and all deficiencies shall be corrected by the CONTRACTOR and site conditions restored prior to final acceptance. All retesting shall be at the CONTRACTOR's expense.
- B. The CONTRACTOR shall notify the Construction Administrator 48 hours prior to installation of any cathodic protection components so that inspections can be scheduled. Phone messages left with others will not be considered adequate notification. The CONTRACTOR shall not backfill any cathodic protection components prior to inspection and approval by the Construction Administrator.

## 5.0 **QUALITY ASSURANCE**

### 5.1 **General**

- A. All work shall be performed to the satisfaction of the DISTRICT.
- B. The CONTRACTOR shall not substitute for the specified materials unless approved by the DISTRICT.
- C. Compaction of backfill and trenches shall match the existing conditions and shall be approved by the DISTRICT.

## 6.0 **INTERFERENCE AND EXACT LOCATIONS**

### 6.1 **General**

- A. The CONTRACTOR shall coordinate and properly relate this work to the site and to the work of all trades. The general locations of the facilities are shown on the drawings. However, the CONTRACTOR shall visit the premises and

thoroughly familiarize himself with all details of the work and working conditions, verify existing conditions in the field, determine the exact locations of existing pipelines and structures and advise the DISTRICT of any discrepancy that may prevent or hinder the specified work from being completed. The CONTRACTOR shall be solely responsible for location and marking underground structures so as to avoid damage during construction.

## 7.0 **CODES**

### 7.1 **Codes and Regulations**

- A. All materials, workmanship, and installation shall conform with all requirements of the legally constituted authority having jurisdiction. These authorities include, but are not limited to, the latest revision of the State of California, Department of Industrial Relations, Division of Industrial Safety Orders of the Industrial Accident Commission, and all other applicable State, County, or City codes and regulations. Nothing in the drawings or specifications is to be construed to permit work not conforming to these regulations and codes. Where larger size or better grade materials than required by these regulations and codes are specified, the specifications and drawings shall have precedence.

## 8.0 **GPS MAPPING**

### 8.1 **GPS Coordinates**

- A. The "as-built" GPS coordinates of all components such as test stations, rectifiers, anode beds, etc. shall be mapped by the CONTRACTOR and provided in a tabular form.

9.0 **REFERENCES**

9.1 **Reference Specifications**

This section contains references to the following documents. They are a part of this section as specified and modified. In case of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

- A. American Society of Testing and Materials (ASTM)
- B. National Electrical Manufacturers Association (NEMA)
- C. Industrial Cable Engineers Association (ICEA)
- D. American Water Works Association (AWWA)
- E. National Association of Corrosion Engineers (NACE)
- F. American National Standards Institute (ANSI)

**\*\*\* END OF SECTION \*\*\***

# RESUME OF EXPERIENCE

Scott M. Nelson

## EDUCATION

Bachelor of Science, Psychology, Industrial Psychology Option, California State University at Hayward, September 2000.

## PROFESSIONAL CERTIFICATIONS

- ?? Certified Corrosion Technician, National Association of Corrosion Engineers
- ?? Certified CP Tester, National Association of Corrosion Engineers
- ?? Certified Water Distribution Operator, Grade II, State of California Department of Health Services

## SUMMARY OF EXPERIENCE AND ACCOMPLISHMENTS:

Over two years of experience in the management in the Corrosion Control Program at Contra Costa Water District (CCWD). Major area of specialization is in cathodic protection. Additional areas include failure analysis, design review, DC transit system stray current studies, material selection for pumping plants, pipelines, and storage tanks.

- ?? Instrumental in setting up new Corrosion Control Program in the Operations & Maintenance Department at CCWD.

- ?? Provided technical assistance and management for CCWD's corrosion consultant's evaluation of thirteen steel tanks and raw water systems

- ?? Provided Corrosion training to staff

Over ten years of experience with the Cross-Connection Control Program at CCWD. Major area of specialization is in database management and staff direction in day-to-day activities.

- ?? Established, organized, and managed Cross Connection Control Program at CCWD

- ?? Instrumental in Cross Connection Control Standards development